

# Many Physicians Aren't Running to Embrace Electronic Consultants

## ELECTRONIC DOCTORS:

Computers in Medicine

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Last of Two Parts

## Artificial Intelligence Scares Some Away

Ever since serious efforts to develop thinking computers began in the 1950s, "artificial intelligence" experts have had to confront critics' visions of a Brave New World.

Now, with the creation of computer programs that can diagnose diseases — and sometimes outperform human physicians in the process — not all doctors are sure they want the help.

"The most profoundly depressing of all ideas about the future of the human species is the concept of artificial intelligence," wrote Dr. Lewis Thomas, chancellor of the Memorial Sloan-Kettering Cancer Center in New York, in an essay lamenting a future with machines running the world.

"The ambition that human beings will ultimately cap their success as evolutionary overachievers by manufacturing computers of such complexity and ingenuity as to be smarter than they are, and that these devices will take over and run the place for human betterment or perhaps, later on, for machine betterment, strikes me as wrong in a deep sense, maybe even evil," Thomas said in a column earlier this year in the New England Journal of Medicine.

His warning — which he later described as more tongue-in-cheek than serious — elicited a rash of responses from researchers involved in the young field of artificial intelligence, including two Stanford University scientists who are in the vanguard of developing computers that can think and act like doctors.

"This research is seeking ways to overcome the tendency toward estrangement between man and machine," contended Drs. Edward H. Shortliffe and Bruce G. Buchanan. "Workers in artificial intelligence are attempting to provide us with computer-based tools that will make doctors more effective thinkers."

Dr. Joshua Lederberg, Nobel Prize-winning president of Rockefeller University and a pioneer in the field, noted in an interview that the term "artificial intelligence" is itself part of the problem.

"The phrase artificial intelligence is so arrogant I would prefer not to use it," Lederberg said. "I think people are put off by that term. I would prefer just to say 'knowledge handling.'"

The endless speculation and over-optimistic enthusiasm that characterized the field in its early years has led Lederberg and many of today's artificial intelligence advocates to tread cautiously into new applications, from energy to health care, while generally shunning publicity.

In seeking approval in the world of medicine, the developers of intelligent computers are taking particular care not to offend practicing physicians or suggest that computers will replace human doctors. To alienate the already skeptical, and powerful, medical community, which has always been alert to potential threats to the traditional doctor-patient relationship, could place an unsurmountable roadblock in the growth of computer medicine.

"We're not trying to put doctors out of business," said Dr. William Baker Jr., a National Institutes of Health official involved in the development of biomedical computer programs. "But medical specialists are going to have to get involved with these systems."

"Medicine is going to have to change. Medical education is putting less and less emphasis on rote learning and more and more emphasis on decision-making. Computers can accumulate accurate knowledge far beyond that which any human mind can hold. People will be forced to work with them," he added.

### Diagnostic Computer Has Name Changed

The computerized medical diagnostic program developed by Drs. Jack Myers and Harry Pople at the University of Pittsburgh, featured in this series, has undergone a name change. Formerly known as INTERNIST, it is now called CADUCEUS. The change was made at the request of the American Society for Internal Medicine, whose publication is named The Internist.

"I cannot imagine replacing a physician with an automaton," Lederberg said. "But as a physician assistant there's a role these programs could play today." Unfortunately, he said, "the resistance is substantial within the medical profession, largely because of misunderstanding of the uses."

With many of the intelligent computer programs getting closer to application, the tiny, tightly knit community of artificial intelligence experts dealing with biomedical problems — fewer than 100 worldwide, by one estimate — is now seeking to expand its ranks, make converts and spread the word to those who eventually will use these products.

Stanford University recently sponsored a special "tutorial" session for practicing doctors. The organizers were "astounded" at the response — more than 200 doctors showed up for a two-day session that began at 8:00 a.m. on a Sunday morning.

Although few medical schools yet offer courses in this area, a select group of institutions are beginning to turn out physicians with a doctorate in computer science as well as an M.D.

"The majority of physicians wouldn't know what we're talking about. It's a whole new field," said Dr. Jack Myers, a University of Pittsburgh internist who has developed the CADUCEUS computer program, which is about to undergo field testing.

What advantages would this and other computer programs offer doctors and patients?

Myers believes that the computer diagnosis of more than 500 diseases available in his CADUCEUS program would not only save doctors time but also save money for the consumer.

"When CADUCEUS is complete and operating, it will save enough in direct patient workups — labs and X-rays — to more than pay for itself. If it works the way I believe it will, it will give indications to physicians as to what needs to be done and what's important to solve the problem."

He estimated it might cost \$25 to \$50 for a computer to analyze a complicated case. And while he agreed that it won't "replace specialists," he said that an expert computer doctor "might cut down on consultants." In today's increasingly specialized medical world, a patient may often be shuttled from doctor to doctor, at great expense, to get an out-of-

the-ordinary health problem diagnosed and treated.

Dr. Donald A.B. Lindberg, a University of Missouri physician who has been active in the evolution of medical computers and information systems for 20 years, believes that "artificial intelligence is good medicine."

But, he said, doctors must necessarily be responsible for the hands-on treatment of patients, observing their symptoms and then deciding whether to ask a computer for help. "If doctors' egos are threatened by computers, we should console ourselves because humans are needed for the actual clinical observations. There is no way we will be bypassed."

He said specialists can never be eliminated because a "smart computer program can only work when it gets good input." But he said that specialized computer programs, like the EXPERT program he is helping develop to diagnose rheumatic diseases, may be particularly attractive when human experts are in short supply.

"If I had a disease, I would want to see an expert. But only 2 percent of people who have arthritis ever see a rheumatologist," Lindberg told doctors attending the Stanford symposium. In a six-month test of difficult case histories, EXPERT correctly diagnosed more than 90 percent of the cases presented.

But even the advocates are concerned that enthusiasm for computer medicine be tempered by realistic assessment of the limitations of artificial intelligence. Not all of medicine can be translated into computer rules, Lindberg said, and the programs themselves must have some built-in capability of deciding when not to act.

"An intelligent program must have some knowledge of its own limitations and offer no advice on some occasions. My lofty goal is for a system to be authoritative when it knows enough and humble when it doesn't."

Over the next 10 to 15 years, he said he expects computers to find their way out of the research setting and into the doctor's office. He said that prospect will be aided not only by advances in artificial intelligence research but by the technology of computers themselves.

The "microprocessor revolution" — making computers smaller and smaller — is advancing so quickly, many expect the hardware problem of developing a desksize computer containing a complicated program to be solved.

Lindberg's more cautious colleagues cringed when asked for "crystal ball" predictions and rejected any estimate of when intelligent medical computers will become a feature of medical practice.

"That's like being asked when you are going to have the cure for cancer. I'd rather be cautious about predictions," said Stanford's Shortliffe. He recalled the early forecasts of his predecessors, which "oversold" the speed with which artificial intelligence would be applied, and said he prefers to avoid further "premature" estimates that might open the field to more criticism.

"It's likely that within 10 years there will be widespread use in clinical settings. But I don't really know exactly what impediments will get in the way," he adds. "We're on the verge of having doctors use our systems, moving research from the labs to tests in clinical settings."

Lederberg said that, in any case, the problems in bringing artificial

intelligence into general practice go far beyond the researchers themselves. They will be "institutional and procedural rather than technical. Who is going to pay for it? Third-party payors (insurance companies) are not going to want added cost during the development period, even though it may pay off later."

Some have also questioned whether computers with the capability of making medical decisions might also raise additional malpractice problems. But one expert in the field said, "if they're good enough, it may become malpractice not to use them."

Nonetheless, should the promising performances of early artificial intelligence efforts prove successful, Lederberg and others believe there is an "excellent" chance that in the foreseeable future every human doctor may be backed up by a clever computer counterpart.